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THE COMPETITIVE EFFECTS OF RESALE PRICE MAINTENANCE*

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ABSTRACT

The competitive effects of resale price maintenance (RPM) are theoretically diverse. RPM can cause allocation distortions or promote productive efficiencies in the distribution process. Moreover, extant cross-sectional empirical evidence is incapable of distinguishing among the potentially disparate effects of RPM. This paper conducts hypothesis tests of the alternative theories of RPM. The empirical framework relates estimates of the effects of RPM for a cross-section of observations to necessary conditions of the alternative models. This analysis indicates that RPM is used both to foster cartels and promote efficiencies in the distribution process. This result is consistent with the growing body of case study analysis that suggests that RPM is used for a variety of reasons. This result also questions the current per se illegal status of RPM in the antitrust laws. Evidence is also provided concerning the strategic interaction between manufacturers and dealers in the distribution process and the use of financial data in analyzing propositions in industrial organization.

I. INTRODUCTION

Economic transactions are often more complicated than the simple price-mediated exchange of conventional markets. The distribution of branded products is exemplary. Contracts governing the distribution process frequently constrain the actions of upstream and downstream firms. Examples include restrictive sales territories, exclusive dealing, requirement contracts, and tying arrangements. These and other methods of vertical control are persistent and increasingly frequent objects of analysis in the industrial organization literature (Warren-Boulton, 1978; Blair and Kaserman, 1983; Mathewson and Winter, 1983a,b, 1984; Bittlingmeyer, 1983; and Marvel and McCafferty, 1984). Indeed, the economic effects of these practices possess important implications for the conduct of antitrust policy and the development of the modern theory of the firm (Rubin, 1977; and Marvel, 1982).

One particular form of vertical control occurs when the upstream firm dictates pricing policies at subsequent stages of the distribution process. This method of vertical control is referred to as resale price maintenance (RPM). Theoretically, RPM can promote allocative distortions in the distribution process by enhancing the discipline of an upstream or downstream cartel. RPM can also create productive efficiencies by mitigating the agency problems of disintegrated distribution. Assessing the actual effects of RPM is, therefore, important both for the development of economic theory and the conduct of antitrust policy. Extant cross-sectional empirical evidence is, however, incapable of distinguishing among the disparate theories of RPM. Additionally, detailed case studies indicate that RPM may possess different economic effects in alternative situations. Thus, "neither the economic theories nor the existing empirical evidence currently offer overwhelming support to any <u>single</u> view concerning RPM" (Overstreet, 1983, p. 1). It is unclear, though, whether this conclusion accurately reflects the diverse effects engendered by RPM or is simply a comment on the inadequacy of received empirical evidence.

This paper conducts tests of the alternative theories of RPM. The framework for these tests consists of two stages. The practice of RPM violates antitrust law. The first stage of the empirical framework examines capital market responses to public and private antitrust enforcement efforts to gain estimates of the motivations and effects of RPM. The second stage of the empirical framework examines the relationship between these estimated effects and necessary conditions of the alternative models. This framework facilitates unbiased tests capable of distinguishing among the alternative theories of RPM. In anticipation, the analysis provides positive support for each of the theories of RPM. Moreover, this analysis identifies a set of variables important for the determination of the economic effects of RPM in each case. These results possess implications for the economic theory of vertical control, the conduct of public policy towards RPM, the interaction between manufacturers and dealers in the distribution process, and the use of capital market

data and analyses for testing propositions in industrial organization.

Section II of this paper presents the alternative theories of RPM and surveys existing empirical evidence. Section III develops the empirical framework used in this paper. Section IV conducts the empirical analysis developed in Section III. Section V contains a discussion of the empirical results contained in this paper. And finally, Section VI is the conclusion.

II. AN OVERVIEW OF RESALE PRICE MAINTENANCE

RPM is a persistent focus of analysis in the industrial organization literature. The theoretical and empirical effects of RPM are also frequently studied by a wide variety of private and governmental organizations. This section of the paper summarizes the theoretical and empirical literature on RPM. Theoretically, the motivations for and economic effects of RPM are diverse. Extant empirical evidence is, unfortunately, of little value in assessing the potentially disparate effects of RPM.

The Theoretical Effects of Resale Price Maintenance

The theoretical debate over RPM illustrates the tensions between the structuralist and transaction costs paradigms in industrial organization. Both paradigms offer explanations for the practice of RPM. Moreover, the welfare consequences of RPM diverge under the alternative models. RPM can diminish the allocative or enhance the productive efficiency of the distribution process.

In the structuralist tradition, the attainment of productive

and allocative efficiency depends critically on elements of market structure.[1] The number of buyers and sellers, product differentiation, barriers to entry, and other characteristics of market structure affect the performance of industries. The structure-conduct-performance paradigm remains an explanatory tool of many contemporary industrial organization economists. This paradigm provides two rationales for RPM.

The structure of the downstream, distribution industry bears on the first structuralist interpretation of RPM. In some cases, the distribution industry is characterized by a paucity of sellers or by retailers that are organized for licensing or promotional purposes. These circumstances can promote collusive behavior among dealers. These dealer cartels, like all cartels, are subject to problems resulting from the divergence of individually rational and joint maximizing strategies by its members. The dealer cartel hypothesis (Yamey, 1952; Bowman, 1952; and Gould and Preston, 1965) contends that (minimum) RPM is imposed on a manufacturer by a cartel of dealers to exploit market power at the distribution stage. RPM enhances collusive behavior by employing the manufacturer to police and enforce members of the dealers' cartel.

Structural conditions of the upstream, manufacturing industry bear on the second structuralist interpretation of RPM. In some cases, the manufacturing industry is characterized by a concentrated group of sellers or barriers to entry. These circumstances can facilitate collusion among manufacturers. The success of the

manufacturers' cartel depends on the monitoring and enforcement practices of the cartel. The manufacturer cartel hypothesis (U.S. Congress, 1952; and Telser, 1960) argues that (minimum) RPM is a rule employed by the manufacturers' cartel to strengthen the discipline of its members. RPM enhances collusive behavior by eliminating incentives for dealers to increase purchases from price-cutting manufacturers and by increasing the observability of a manufacturer's pricing policies.[2]

The welfare consequences of structuralist applications of RPM are straightforward. In both the dealer and manufacturer cartel cases, the final price of the product is higher and output lower than would prevail given competitive industry structures. Factor distortions can also occur if substitution opportunities exist between the manufacturing and distributing sector. A structuralist analysis implies that RPM can create allocative distortions in output and input markets.

Exchange in a decentralized economy is itself costly. The costs of transacting can be large in situations where traders are asymmetrically informed. Transaction costs can also be high in the absence of well-specified property rights. In the transaction costs tradition, the existence of business organizations and practices reduce the costs of exchange.[3] Complex institutional arrangements, such as conglomerate enterprise and vertical integration, are endogenous responses to costly transactions. The transaction costs paradigm is a useful tool for understanding the motivations and

effects of diverse commercial arrangements. This paradigm offers several rationales for RPM.

The existence of imperfect information in product markets can motivate a transaction costs application of RPM. It is often costly for consumers to assess ex ante the quality of products. Dealers can provide information about a product in several ways. Dealers can perform demonstrations or instructional services concerning the usefulness of a product. Dealers may also generate signals about the quality of a product. Both of these activities can be important sources of interbrand competition in an industry. It is difficult, however, to sustain equilibria involving dealer services or signaling. In a simple price-mediated wholesale market, equilibria characterized by a level of dealer services or signals consistent with the maximization of all of the dealers' profits are unattainable. Each dealer has an incentive to free-ride on services provided by other dealers. Additional restrictions are required to gain efficient equilibria. RPM is one such restriction. RPM (minimum) shifts intrabrand competition among dealers away from price and towards the provision of dealer services or signaling. The resulting equilibria can maximize the joint profits of the dealers.[4] RPM can mitigate horizontal externalities among dealers (Telser, 1960; Mathewson and Winter, 1983a; Marvel and McCafferty, 1984).

Dealers can also facilitate the distribution of a product by their locational decisions. A spatial distribution of dealer locations that resembles the distribution of potential consumers

minimizes aggregate transportation costs. This pattern of dealer locations, however, generates a spatial monopoly for each dealer. RPM (maximum) can be used by a manufacturer to achieve an efficient spatial distribution of dealers while maintaining a retail margin consistent with competition at the distribution stage. RPM can avoid the vertical externality of successive monopoly (Warren-Boulton, 1977; Bittlingmayer, 1983).

The absence of well-specified property rights between the manufacturer and a dealer can also motivate a transaction costs application of RPM. The success of the product at retail in many cases depends on activities undertaken by both the manufacturer and its dealers. In these situations it is impossible to impute either the dealer's or manufacturer's inputs by observing retail price alone. The costliness of monitoring inputs creates a problem of moral hazard between the manufacturer and each dealer. A simple price-mediated wholesale market results in the manufacturer and dealers supplying inputs at levels inconsistent with the maximization of their joint profits. Additional restrictions are required to attain equilibria that maximize the joint profits of the manufacturer and its dealers. RPM is such a restriction.[5] RPM (minimum) is a sharing mechanism that provides incentives for both the manufacturer and any one dealer to supply inputs yielding efficient equilibria (Klein and Murphy, 1983).

The welfare consequences of transaction costs applications of RPM are straightforward. RPM promotes productive efficiencies in the distribution process when there are horizontal externalities among

dealers or vertical externalities between dealers and the manufacturer. RPM is a contractual form that mitigates or eliminates the agency problems of disintegrated distribution when simple price-mediated exchange in the wholesale market results in outcomes inconsistent with the maximization of the joint profits of the manufacturer and the dealers.[6]

Empirical Studies of Resale Price Maintenance

The industrial organiztion literature is replete with empirical studies of RPM. Cross-sectional studies of RPM typically employ one of two methodologies. First, the relationship between the use of RPM and the retail price of the product is examined (Overstreet, 1983, p. 106-117). The motivation for conducting such studies is straightforward given a structuralist perspective. A reduction in the variation of prices to consumers is indicative of lessened competition and a high degree of price discipline among members of a cartel. Similarly, "[i]f, as has been suggested, resale price maintenance can be expected to make for less rather than more competition, it is reasonable to expect that its use would make for higher consumer prices" (Bowman, 1955, p. 850). In general, the variance of retail prices is smaller and the level higher when distribution occurs in a RPM regime.

The methodologies and conclusions of empirical price studies are criticized on many grounds (Frankel, 1955; and McLaughlin, 1979). For the current purpose it is sufficient to note that the implications of the structuralist and transaction costs theories with respect to

price variation and level are indistinguishable. If uniform retail pricing is a necessary condition for the efficiency of disintegrated distribution, a reduction in the variation of retail prices results. Moreover, if RPM is employed to induce distributors to provide services or quality inputs or signal product quality, a positive correlation between the use of RPM and product price is expected. The introduction of RPM creates a change in the composition of the product that increases its value to the consumer (Bork, 1978, p. 296). Thus, price studies cannot be relied upon to differentiate among the disparate hypotheses of RPM.

A second type of empirical study analyzes the effect of RPM on the average size of retail outlets (Weiss, 1967). Cartels with free entry result in excess capacity. A structuralist perspective argues that RPM reduces the average size of retail outlets still further since the maintained retail price is higher than would otherwise prevail. There is some evidence that the use of RPM is inversely related to the size of retail outlets.

The structuralist and transaction costs theories have identical implications for the relationship between RPM and the average size of retail outlets (Marvel and McCafferty, 1984). Mass distributors compete primarily on price and depend upon high volume to exploit economies associated with inventory and warehousing. These dealers are placed at a competitive disadvantage upon the inception of RPM. Mass distributors must mimic the techniques of dealers who provide services or signals to consumers or exit the market in the

distribution of goods that are price maintained. Either of these adjustments results in a reduction in the average size of dealer outlets. If RPM is employed to mitigate the agency problems of disintegrated distribution, equilibria in the structure of the distribution industry are characterized by smaller retail outlets. Thus, studies that examine the relationship between RPM and the average size of dealer outlets are incapable of discriminating among the theories of RPM.[7]

Case study analyses are important sources of information about RPM. The motivations and effects of RPM are examined across a wide group of products and industries (Overstreet, 1983, p. 119-125). These studies suggest that RPM is used both to promote cartel stability and address agency problems in the distribution of branded products. The possibility that RPM may deter efficiency in some cases while promoting it in others further limits the usefulness of extant cross-sectional studies. The highly aggregated level of analysis in these studies does not permit the alternative theories of RPM to hold simultaneously. An implicit assumption of such studies is that RPM is used <u>either</u> to foster cartels or promote distributional efficiencies. These empirical designs bias at least one of the alternative hypotheses towards the null hypothesis. Thus, inferences derived from existing cross-sectional empirical work are not only incapable of distinguishing among competing hypotheses, but they are biased as well.

III. AN OVERVIEW OF THE EMPIRICAL FRAMEWORK

The history of public policy towards RPM is quite rich. This policy clearly plays a role in a firm's decision to employ RPM. The ambivalence and vicissitudes of this policy caused many firms to adopt RPM distribution practices that were subsequently subjected to antitrust challenge.[8] For example, from the beginning of 1960 through the end of 1981, the Federal Trade Commission (FTC) and the Antitrust Division of the Justice Department (JD) filed more than 110 complaints in efforts to enjoin firms from employing RPM. The vast majority of these complaints resulted in the adoption of alternative cartel management or distribution techniques. This section of the paper identifies the expected effects of these complaints on the profits of relevant firms conditioned on the alternative theories of RPM. It also indentifies some necessary conditons of these theories and their relationship to the profit effects of the antitrust complaints.

The Implications of Antitrust Enforcement

Alternative mechanisms exist to sustain a dealers' or manufacturers' cartel or mitigate the agency problems of disintegrated distribution. These alternatives are, however, less effective or more costly. A manufacturers' or dealers' cartel or a manufacturer by itself would not rationally choose RPM if a less costly cartel management or distribution mechanism exists. Consequently, antitrust complaints alter the subsequent revenues or increase the costs of firms affected by RPM. The qualitative effect of the antitrust challenge on the future profits of the manufacturing firm named in the

complaint and its competitors yields an estimate of the economic motivations for RPM. The comparative statics effects of an antitrust challenge on these firm's profits conditioned on the alternative theories of RPM are developed below.

Assume that the purpose of RPM is to foster a dealers' cartel. Then RPM has a non-positive effect on the manufacturer's profits. If the manufacturer possesses monopoly power or employs Ricardian factors, rent shifting to the distribution level occurs. The cartel obtains the monopoly profits from output restriction and the rents that would normally accrue to the manufacturer given a competitive distribution industry. If the manufacturer is in a competitive industry characterized by homogeneous technology and access to productive inputs, the effects of the cartel are null. The manufacturer must earn at least a competitive rate of return in equilibrium. RPM has an indeterminate effect on the manufacturer's rivals' profits. If the manufacturer's competitors are subject to the dealers' cartel, its effect on their profits is also non-positive for the same reasons outlined above. However, the manufacturer's rivals can conceivably benefit from interbrand shifting if they are unencumbered by the dealers' cartel (Posner, 1976, p. 148). Thus, if RPM is facilitating a dealers' cartel, the qualitative effect of an antitrust challenge on the future profits of the manufacturing firm named in the complaint is non-negative. The effect of the complaint on the manufacturer's rivals' future profits is indeterminate.

Assume, instead, that the purpose of RPM is to foster a

manufacturers' cartel. Then RPM has a positive effect on the profits of the manufacturer. RPM also has a positive effect on the profits of the manufacturer's competitors. If the cartel contains all of the firms in the manufacturing industry, successful collusion results in output restriction strategies that increase the profits to members of the cartel. If RPM facilitates a manufacturers' cartel containing only dominant firms, the dominant firm group benefits while fringe firms can free-ride on the subsequent price discipline. Even the marginal firm in the industry benefits from the cartel. Thus, if RPM is facilitating a manufacturers' cartel, the qualitative effect of an antitrust challenge on the future profits of the manufacturer named in the complaint is negative. The effect of the complaint on the manufacturer's competitors' future profits is also negative.

Assume, now, that RPM is employed to mitigate or eliminate the agency problems of disintegrated distribution. RPM has a positive effect on the profits of the manufacturer. RPM reduces the manufacturer's distribution costs. RPM has a non-positive effect on the profits of the manufacturer's competitors. It cannot benefit the manufacturer's competitors for the manufacturer to employ a least cost method of product distribution. This holds regardless of the distribution regimes employed by the manufacturer's competitors. Thus, if RPM reduces the agency costs of disintegrated distribution, the effect of an antitrust challenge on the future profits of the manufacturer named in the complaint is negative. The effect of the challenge on the manufacturer's competitors future profits is non-

negative.

Table 1 depicts the qualitative reactions of the manufacturing firm's and its competitors' future profits to an antitrust complaint resulting in the discontinuation of RPM given the alternative theories. The economic effects of RPM in a particular case are uniquely determined by the configuration of these reactions.

Necessary Conditions of the Alternative Hypotheses

Whether RPM is used to foster a cartel or promote efficient product distribution depends on certain structural characteristics of the firm and industry. Some of these characteristics are identified below. Examining the relationships between these characteristics and the estimated effects of RPM for a cross-section of observations provides tests of the alternative theories.

A necessary condition for the use of RPM to promote a dealers' or manufacturers' cartel is some degree of intra-industry coordination. Dealers or producers at the distribution or manufacturing levels must cooperate to establish and enforce rules that restrict output and generate monopoly rents. In the structuralist tradition, seller-concentration is the most frequently used proxy of intra-industry cooperation (Scherer, 1980, p. 267-96). The probability of detecting firms that defect from the optimal cartel strategy is inversely related to the number of cartel members (Bain, 1951; and Stigler, 1964). Put simply, the costs of maintaining collusive agreements are lower the fewer the participants. If the structuralist theories of RPM are valid, measures of seller

TABLE 1

EQUILIBRIUM RESPONSE TAXONOMY

	Qualitative change in future profits due to RPM antitrust complaint	
Hypothesis	Manufacturer	Manufacturer's Competitors
Dealer Cartel	(0) or (+)	(-), (0) or (+)
Manufacturer Cartel	(0) or (-)	(-)
Transaction Costs	(0) or (-)	(0) or (+)

concentration in the production and distribution industries should discriminate among the estimated effects. Moreover, higher levels of concentration in the manufacturing and distributing sectors should correlate directly with observations where RPM is estimated to foster manufacturers' and dealers' cartels, respectively.

A necessary condition for transaction costs applications of RPM is the existence of agency costs in the distribution process. Assume that such costs exist. In both the case of horizontal externalities among dealers and vertical externalities between a dealer and the manufacturer, these agency costs are an increasing function of the size of the manufacturing firm.[9] The relative costs of controlling a disintegrated distribution system are increasing in the size of the firm. A larger manufacturer must interact with more dealers for a given efficient scale at the distribution level. Given a cross-section of firms from different industries, the size of a firm relative to its competitors, the firm's market share, reflects the differential costs of disintegrated distribution in the presence of agency problems. If the transaction costs theory is valid, measures of the manufacturing firm's market share should discriminate among the estimated effects of RPM. Moreover, market share should correlate directly with observations where RPM is estimated to mitigate agency problems in the distribution process.

IV. AN EMPIRICAL ANALYSIS OF RESALE PRICE MAINTENANCE

This section of the paper conducts the empirical analysis developed above. This analysis consists of two stages. The first

stage makes use of public and private antitrust enforcement efforts to gain estimates of the economic effects of RPM. The second stage examines the relationship between these estimated effects of RPM and necessary conditions of the alternative theories. Jointly, this procedure permits tests of the disparate theories of RPM.

Measuring the Effects of Antitrust Enforcement

In principle, changes in the recorded profits of a manufacturer and its competitors subsequent to an antitrust challenge can be used to assess the economic motivations of RPM. The problems of using accounting profits to measure economic profits are, however, legion (Lindenberg and Ross, 1981; Fisher and McGowen, 1983). Moreover, the dynamic relationship between the adoption of a new cartel management or distribution technique and registered profits cannot ex ante be known. An alternative method of measuring the change in economic profits subsequent to an antitrust challenge against RPM is warranted.

The use of financial data to measure changes in the future profits of enterprises is a standard practice in the accounting and finance literatures (Fama, Fisher, Jensen and Roll, 1969). This methodology is increasingly prevalent in the empirical, industrial organization literature (Burns, 1977; Eckbo, 1983; and Chalk, 1984). If the abandonment of RPM in the distribution of products is largely unanticipated or the probability of its termination is altered by antitrust challenges, the "efficient markets, rational expectations" (Muth, 1961) hypothesis implies that contemporaneous changes in

security prices represent unbiased estimates of the expected changes in the future profits of firms affected by RPM. That is, "an efficient capital market sets the prices of assets equal to the present value of the expected future cash flows, thus reflecting the total impact of regulatory change on shareholder wealth" (Schwert, 1981, p. 123-24).

The capital market effects of RPM antitrust challenges are examined below.[10] Several steps are required to conduct these analyses. First, the initial sample is drawn from antitrust complaints brought by the Federal Trade Commission (FTC), the Antitrust Division of the Justice Department (JD), and private individuals and corporations against firms employing RPM. The majority of these challenges are brought under Section I of the Sherman Antitrust Act or Section 5 of the Federal Trade Commission Act. A small number of suits are brought under the Robinson-Patman Act. All of these complaints challenge the practice of RPM.

Second, information contained in the complaints themselves and firm-specific data gathered from alternate sources (Moody's Industrial Manual and Standard and Poor's Registry of Corporations) are used to assign a set of 4-digit SIC product codes to each case. If the product named in a complaint corresponds with an existing 4-digit SIC, such as tire manufacturing (3011), a single code is assigned. If no single 4-digit SIC sufficiently encompasses the products distributed under RPM and named in the complaint, such as women's dresses, lingerie and sportswear (2335,2339,2341), or close substitutes are

available, such as fine china dinnerware (3262,3263) and china and glassware (3229), multiple codes are assigned. These codes are used to identify a set of potential competitors for the manufacturing firm. Firms in this set that are also listed on the CRSP daily stock return tape are the competitors used in the analyses.

Third, Wall Street Journal announcements of the disposition of the antitrust complaints represent changes in the information available to market participants. The assumption that changes in information coincide with these announcements is frequently employed in the literature (Eckbo, 1983; Dodd and Warner, 1983; and Stillman, 1983). These announcements reflect changes in investors' assessments of the future profits of firms affected by the marketing practice of RPM. Consequently, antitrust complaints unreported by the Wall Street Journal are excluded from the sample.

Fourth, stock return models for the manufacturing firm named in the antitrust challenge and a portfolio of its competitors are estimated for each case. The purpose of these estimations is to measure changes in capital market participants' assessments of the future profits of these firms resulting from the antitrust complaint. These models must control for other changes unrelated to the antitrust challenge. The market model (Fama, 1976), a standard model of the stock return generating process, is used for this purpose. This model relates the return to any individual security or portfolio of securities to the return on a portfolio consisting of all traded securities. This later portfolio is often referred to as the market

portfolio. The market model is also consistent with the return generating process implied by a portfolio-theoretic approach such as the Capital Asset Pricing Model (Sharpe, 1963). The following system, containing two modified market models, is estimated for each antitrust complaint using Zellner's (1962) Seemingly Unrelated Regression Model (SURM):

$$R_{ft} = \alpha_{f0} + \beta_{f0}R_{mt} + \sum_{i=1}^{k}\alpha_{fi}D_{it} + \sum_{i=1}^{k}\beta_{fi}D_{it}R_{mt} + \gamma_{f1}NEG_t + \gamma_{f2}POS_t + \mu_{ft}, \qquad t = 1,\ldots,260$$

$$R_{ct} = \alpha_{c0} + \beta_{c0}R_{mt} + \sum_{i=1}^{k}\alpha_{ci}D_{it} + \sum_{i=1}^{k}\beta_{ci}D_{it}R_{mt} + \gamma_{c1}NEG_t + \gamma_{c2}POS_t + \mu_{ct}, \qquad t = 1,\ldots,260 \tag{1}$$

where

R_{ft} = stock return of the manufacturing firm named in the complaint over week t,

R_{ct} = stock return of an equally weighted portfolio of the manufacturing firm's competitors over week t,

R_{mt} = stock return of the value-weighted market portfolio over week t,

D_{it} = a dummy variable equal to zero prior to the ith bit of information pertaining to the antitrust complaint and one thereafter, i=1,...,k,

NEG_t = a dummy variable equal to one if the ith bit of

information decreases the probability of employing RPM and occurs in week t and zero otherwise, and

POS_t = a dummy variable equal to one if the ith bit of information increases the probability of employing RPM and occurs in week t and zero otherwise, and

μ_{ft}, μ_{ct} = the disturbance terms over week t.

The specification of system (1) minimizes the potential influence of various data problems in several ways.[11] System (1) also provides estimates of changes in the future profits of the upstream firm named in the antitrust complaint and its competitors. The dummy variables NEG_t and POS_t are equal to one in week t if information decreasing or increasing, respectively, the probability of employing RPM occurs in week t and zero otherwise. Examples of information that decrease this probability are public allegations that a firm is violating a statute by employing RPM, rulings by an FTC examiner that the marketing practices of a firm are illegal, or consent decrees prohibiting a firm from utilizing RPM. Examples of information that increase this probability are terminations of current antitrust suits which do not alter the marketing practices of the firm or court actions that retire or lift existing antitrust agency prohibitions against RPM. The estimates γ_{f1}, γ_{f2}, γ_{c1}, and γ_{c2} represent unexpected or abnormal changes in the stock returns of the manufacturer and its competitors due to the antitrust challenge. Given the efficient markets, rational expectations hypothesis, these

estimates are unbiased measures of the changes in the capitalized profits of these firms due to the antitrust action.

The initial sample of RPM antitrust cases is drawn from complaints brought by the FTC, JD, and private individuals and corporations. The use of Wall Street Journal announcements concerning the disposition of antitrust complaints reduces the sample considerably. The use of the CRSP tape to obtain daily stock return data limits the period from which the sample may be drawn to July, 1962 until the present. The final sample contains 45 antitrust complaints; 19 initiated by the FTC, 19 by the JD, and 7 by private concerns and individuals. Table A.1 lists the complaints used in the current study. Appendix A also provides an example of the application of the empirical framework to one observation in the sample.

The Significance of RPM Antitrust Enforcement

The formulation developed above permits an analysis of the significance of an antitrust challenge for the capitalized value of firms. This analysis is informative for two reasons. First, it reflects on the importance of the practice of RPM. The availability of close substitutes, such as non-price vertical restrictions, diminishes the capital market effects of RPM antitrust enforcement. Second, this analysis reflects on the assumptions used in the empirical formulation. Failures of one or more of these assumptions reduce the significance of the abnormal performance estimates.

Table 2 provides information on the statistical significance of the 45 capital market studies conducted in this paper. The first

TABLE 2

SIGNIFICANCE OF THE CAPITAL MARKET RESPONSE
TO RPM ANTITRUST COMPLAINTS
Cross-sectional distribution of SURM R-square and τ_i,
i = 1,...,45

	Variables	
	SURM System R-Square	τ_i = PROB($\gamma_{f1}=\gamma_{f2}=\gamma_{c1}=\gamma_{c2}=0$)
Mean	.36680	.44102
Standard deviation	.13689	.29439
Fractiles of the sample distribution		
.10	.18148	.03360
.25	.25395	.21880
.50	.35670	.36160
.75	.47215	.63965
.90	.57974	.88180
Maximum	.61050	.99850
Minimum	.12570	.00160
$-2\sum_{i=1}^{45}\log(\tau_i)$	--	115.937*

*Significant at the .05 percent level.

column of Table 2 presents statistics on the cross-sectional distribution of the weighted SURM R-squares. The SURM R-squares for the studies range from .126 to .661 and have a mean of .367 and median of .357. The standard deviation of the SURM R-squares for the sample is .137. The second column of Table 2 presents statistics on the cross-sectional distribution of the probability levels associated with the test of the null hypothesis that all of the abnormal return parameters of system (1) are equal to zero.[12] These probability levels, denoted τ_i, i=1,2,...,45, represent the probability of rejecting the null hypothesis that $\gamma_{f1}=\gamma_{f2}=\gamma_{c1}=\gamma_{c2}=0$ in any one capital market analysis when in fact it is true. This is a test of the significance of the antitrust complaint for the future profits of firms affected by RPM. The τ_i for the 45 event studies ranges from .0016 (the most significant) to .9985 (the least significant) and have a mean of .4410 and a median of .3616. For half the sample the null hypothesis can be rejected at a .3616 level of certainty. For 25% of the sample, the null hypothesis can be rejected with a .2188 degree of certainty.

The second column of Table 2 indicates that the measured effects of the antitrust challenges vary widely across cases in the sample. A test of the hypothesis that, on average, this reaction is not significantly different from zero is conducted. That is, can the explanation of the time series of rates of return to firms involved in RPM antitrust cases be enhanced by considering information pertaining to the disposition of the antitrust challenge? Since τ_i, i=1,...,45,

is distributed uniformly on the unit interval under the null hypothesis, $-2\log(\tau_i)$ is distributed as a chi-square with 2 degrees of freedom. Since the estimation periods in the individual event studies are different, the τ_i are independent and $-2\sum_{i=1}^{45}\log(\tau_i)$ is distributed $\chi^2(90)$ (Maddala, 1977, p. 47-48). As can be seen in the last row of Table 2, rejection of the null hypotheses at a high level of significance is possible. On average, information about the disposition of RPM antitrust challenges affects the future profits of firms. This result reflects positively on the importance of RPM for these firms and the validity of the assumptions employed in the empirical framework.

Assessing the Effects of RPM

The empirical formulation also yields measures of the economic effects of RPM for each case.[13] These measures are obtained by evaluating the qualitative configuration of the abnormal return estimates of system (1) according to the comparative static predictions summarized in Table 1. Posterior probabilities that the alternative motivations of RPM underlie these estimates are calculated for each case. These calculations are used to summarize the capital market analyses and conduct hypothesis tests of RPM.

Bayes Theorem is used to obtain estimates of the effects of RPM for each observation in the sample. Recall that there are three potential motivations for employing RPM. Let m_i, i=1,2,3, index these rationales. Recall, too, that the $\gamma = (\gamma_{f1}, \gamma_{f2}, \gamma_{c1}, \gamma_{c2})$ of system (1) summarize information relevant for assessing the effects of RPM

antitrust complaints on the future profits of firms. Following Bayes' Theorem, the posterior probability of m_i given γ is equal to the likelihood of the γ given m_i times the prior probability of m_i divided by the likelihood of the γ given m_j times the prior probability of m_j summed over all m_j, j=1,2,3. That is, $p(m_i|\gamma) = \lambda(\gamma|m_i)p(m_i)/\sum_{j=1}^{3}\lambda(\gamma|m_j)p(m_j)$ where $p(\cdot)$ represents a probability density function and $\lambda(\cdot|\cdot)$ is a likelihood function. The posterior probability of the m_i, i=1,2,3, conditional on γ can be calculated for each case given a likelihood function and prior probabilities. The likelihood function $\lambda(\gamma|m_i)$, i=1,2,3, is well-defined under the assumption that the elements of γ are independent and $N(\hat{\gamma},\hat{\sigma}_\gamma)$ where $\hat{\gamma}$ are the estimates and $\hat{\sigma}_\gamma$ the standard error of the estimates of system (1).

Posterior probabilities of the alternative theories of RPM given the $\hat{\gamma}$ are calculated for each of the 45 observations in the sample assuming equal priors. Appendix A provides an example of the calculation of $p(m_i|\hat{\gamma})$, i=1,2,3, for one of the observations in the sample. Table 3 reports the cross-sectional distributions of these probabilities. The first column of this table presents some statistics of the cross-sectional probability that the $\hat{\gamma}$ of system (1) are generated in regimes where RPM fosters a dealers' cartel. The range for this probability is .0072 to .9974. The mean probability that RPM facilitates a dealers' cartel across the 45 observations in the sample is .2764 while the median is .1405. The second column of Table 3 presents some statistics of the cross-sectional probability

TABLE 3

POSTERIOR PROBABILITIES OF THE ALTERNATIVE THEORIES ACCORDING TO THE CAPITAL MARKET RESPONSES*

Cross-sectional distributions of the probabilities of the alternative theories of RPM

	Variables		
	Probability of Dealer Cartel	Probability of Manufacturer Cartel	Probability of Transaction Cost Application
Mean	.27638	.33879	.38483
Standard deviation	.28220	.26148	.28352
Fractiles of the sample distribution			
.10	.02273	.00409	.05430
.25	.06283	.09252	.13113
.50	.14048	.32038	.36036
.75	.47118	.52440	.58547
.90	.77969	.73240	.84710
Maximum	.99742	.88310	.94910
Minimum	.00718	.00040	.00019

*Prior probabilities are assumed equal.

that the $\hat{\gamma}$ of system (1) are generated in regimes where RPM fosters a manufacturers' cartel. The range for this probability is .0004 to .8831. The mean probability that RPM facilitates a manufacturers' cartel across the 45 observations in the sample is .3388 while the median is .3204. Finally, the third column of Table 3 presents some statistics of the cross-sectional probability that the $\hat{\gamma}$ of system (1) are generated in regimes where RPM is used to achieve efficiencies in product distribution. The range for this probability is .0002 to .9491. The mean probability that RPM facilitates efficient product distribution across the 45 observations in the sample is .3848 while the median is .3603. In general, the results of Table 3 suggest either that the effects of RPM in the current sample are approximately uniformly distributed across the three theoretic rationales or that inferences based on the capital market analyses of antitrust complaints are meaningless. The validity of these competing interpretations are analyzed below.

Hypothesis Tests of RPM Theories

The capital market analysis through Bayes Theorem yield a joint posterior probability structure over the theoretic rationales for RPM. An analysis of the relationship between the necessary conditions of the alternative theories and this joint posterior probability structure permits hypothesis tests of the theories. Such an analysis also reflects on the validity of drawing inferences about the effects of RPM from the capital analyses.

Three variables are used to estimate differences in these posterior probabilities across observations in the sample. These variables are the four-firm measures of industrial concentration at the distribution and manufacturing stage and the market share of the upstream firm named in the antitrust complaint. These data are obtained from a variety of sources. Concentration measures for the distribution industry (DC) are taken from the 1977 Census of Retailers. This is the first year for which concentration measures in the retailing sector are reported.[14] Concentration measures for the manufacturing industry (MC) are taken from the Census of Manufacturers for the publication year nearest the actual date of the antitrust complaint. The market share of the upstream firm (SH) is created by dividing the upstream firm's sales of price maintained products by the value of shipments in that industry. The firm's sales of price maintained products are estimated by using information in the antitrust complaint and firm-specific data contained in Moody's Industrial Manual. The value of shipments is contained in the Survey of Manufacturers. Both the firm's sales and the value of shipments are from the year in which the antitrust complaint is actually initiated. Table 4 presents some summary statistics of the cross-sectional distribution of these variables for the current sample.

System (2) is estimated to assess the relationship between the joint posterior probability structure obtained through the capital market analyses and DC, MC, and SH:

TABLE 4

SUMMARY STATISTICS*

Cross-sectional distributions of variables used in system (2)

	Variables		
	Dealer Concentration	Manufacturer Concentration	Market Share
Mean	9.66	43.57	12.98
Standard Deviation	6.11	19.07	12.90
Fractiles of the Sample Distribution			
.10	3.5	22.2	0.60
.25	5.1	28.0	3.35
.50	9.1	38.0	10.94
.75	14.4	58.5	15.40
.90	17.6	69.4	34.20
Maximum	26.2	91.0	53.90
Minimum	1.4	18.0	0.20

*Two observations (Beechcraft and Piper) are omitted.

$$\log(p_{j1}/p_{j3}) = \delta_{10} + \delta_{11}\log(DC_j) + \delta_{12}\log(MC_j) + \delta_{13}\log(SH_j) + \varepsilon_{1j}, \quad j = 1,\ldots,n$$

$$\log(p_{j2}/p_{j3}) = \delta_{20} + \delta_{21}\log(DC_j) + \delta_{22}\log(MC_j) + \delta_{23}\log(SH_j) + \varepsilon_{2j}, \quad j = 1,\ldots,n \qquad (2)$$

where

p_{j1} = the posterior probability that the jth observation is consistent with the dealers' cartel hypothesis,

p_{j2} = the posterior probability that the jth observation is consistent with the manufacturers' cartel hypothesis,

p_{j3} = the posterior probability that the jth observation is consistent with the transaction costs hypothesis,

DC_j = the 4-firm concentration ratio at the distribution stage for the jth observation,

MC_j = the 4-firm concentration ratio at the manufacturing stage for the jth observation,

SH_j = the market share of the upstream firm for the jth observation, and

$\varepsilon_{1j}, \varepsilon_{2j}$ = the disturbance terms over observation j.

This model posits a linear relationship between the log of the ratios of the posterior probability estimates and the log of the hypothesized explanatory variables. Ordinarily, the probability distributions must be estimated from actual frequencies. Least-squares estimation results in heteroscedasticity of the error terms. In the current application, however, the capital market analyses through Bayes Theorem yield direct estimates of the posterior probabilities that a given RPM motivation, m_i, i=1,2,3, underlies the $\hat{\gamma}$. The ratios of these estimates serve as the dependent variables in the multivariate probit system. The logarithmic transformation of the odds ratios scales the dependent variables from $(-\infty,\infty)$. Thus, problems of heteroscedasticity normally associated with probit analyses are not present in system (2).

A different source of heteroscedasticity is possible in system (2), however. The estimates of p_{ji}, i=1,2,3, used in system (2) are derived from time-series regression equations that vary substantially in their explanatory power across observations in the sample. In particular, the precision of the $\hat{\gamma}$ for the individual capital market analyses is widely distributed. Heteroscedasticity of the error terms of system (2) according to the precision of the $\hat{\gamma}$ is thus a consideration. The probability level associated with the null hypothesis that all of the abnormal return estimates of system (1) are equal to zero quantifies the precision of the $\hat{\gamma}$. The lower the probability level, the lower the expected variance of the error for a given observation in the sample. These variance-of-error proxies are incorporated in system (2) by weighting each observation by the

inverse of the probability level associated with the hypotheses that $\hat{\gamma} = 0$. This procedure yields a weighted least-squares regression analysis where the weights are $1/\tau_j$, $j = 1,..,n$.

The capital market analyses yield estimates of the probabilities that each of the alternative theories of RPM underlies the $\hat{\gamma}$ of the system (1). Since $\sum_{i=1}^{3} p_i = 1$ for all $j = 1,...,n$, only two of these probability estimates are independent. For instance, errors in the estimation of p_1 are correlated with errors in the estimation p_2 or p_3 in system (2). Thus, system (2) is estimated usually Zellner's Seeming Unrelated Regression Model (SURM). This technique is employed to account for the correlation between ε_{1j} and ε_{2j}, $j = 1,...,n$. The properties of this technique are developed above.

The logarithmic transformation of the RHS variables in system (2) mitigates potential non-linearities in the relationship between the odds ratios and these variables. It also facilitates calculation of the (mean) relationships between the RHS variables and the individual p_i, i=1,2,3. Recall that the $\log(p_1/p_3)$ and $\log(p_2/p_3)$ are equal to $\log p_1 - \log p_3$ and $\log p_2 - \log p_3$, respectively, and $\sum_{i=1}^{3} p_i = 1$ for each observation j, $j = 1,...,n$. The derivative of the two equations in system (2) and the probability constraint with respect to the log of a given RHS variable yields a set of three equations with three unknowns. The unknowns in the set of three equations are the elasticities of the posterior probabilities with respect to a given RHS variable. By solving this set of equations, estimates for the

percentage change in a p_i, i=1,2,3, resulting from a percent change in a given RHS variable can be obtained.[15]

A weighted SURM estimation of system (2) is conducted using 43 observations in the sample. Two observations (Beechcraft and Piper) are deleted since data on DC cannot be obtained. Table 5 contains the estimation results. Table 5 also contains the elasticity calculations $(\partial \log p_1)/(\partial \log x_m)$ and significance tests where p_1, p_2, and p_3 are the posterior probabilities that RPM is facilitating a dealer's cartel, a manufacturers' cartel, or efficiencies in the distribution process, respectively. The x_m represents the RHS variables.

The overall explanatory power of system (2) is good. A test of the null hypothesis that the joint probability structure is unaffected by all of the explanatory variables yields an F(6,78) of 14.338. This value is significant at the 1% level. Moreover, tests of the hypotheses that the joint probability structure is unaffected by the individual independent variables, reported in the last column of Table 5, can be rejected at the 1% level in all three cases. Concentration measures at the distribution and manufacturing stages and the market share of the manufacturing firm are relevant for explaining the posterior probabilities of the effects of RPM developed through the capital market studies.

The effects of the explanatory variables on the joint probability structure are consistent with all of the theories of RPM. The value of $(\partial \log p_1)/(\partial \log DC)$ is 4.249. Higher levels of concentration in the distribution industry increase the probability

TABLE 5

ESTIMATION OF SYSTEM (2) AND CALCULATION OF MEAN VALUES FOR $(\partial \log p_1)/(\partial \log x_m)$

Independent Variables	Parameter Estimates		Elasticity Calculations $(\partial \log p_i)/(\partial \log x_m)$			
	$\log(p_1/p_3)$	$\log(p_2/p_3)$	$\log p_1$	$\log p_2$	$\log p_3$	F(2,78)
log(DC)	8.853	6.366	4.249	1.763	-4.604	26.719
log(MC)	-6.286	-2.368	-3.747	0.172	2.540	5.903
log(SH)	-0.738	-1.796	0.074	-0.984	0.813	8.162
constant	7.948	-2.867				

[a]The F-statistic values reported are for the null hypothesis that the joint probability structure is unaffected by the variable. All of the F-statistic values are significant at the 1 percent level. The F-statistic value for the system is 14.338 which is also significant at the 1 percent level.

that RPM facilitates a dealers' cartel. The value for $(\partial \log p_2)/(\partial \log MC)$ is 0.172. Higher levels of concentration in the manufacturing industry increase the probability that RPM facilitates a manufacturers' cartel. The value of $(\partial \log p_3)/(\partial \log SH)$ is 0.813. Firms with larger market shares are more likely to use RPM to reduce their distribution costs. All three results are consistent with the predicted effects of RPM under the alternative hypotheses. Since these estimates are elasticities, the quantitative effects of the independent variables on the position probabilities may be evaluated in the usual manner.

The elasticity calculations presented in Table 5 bear on several other aspects of the relationship between manufacturers and distributors. The inverse relationship between transaction costs applications of RPM and dealer concentration $(\partial \log p_3)/(\partial \log DC)$ can be indicative of the costs of disintegrated distribution. Concentrated distribution industries may be amenable to less formal, and less costly, forms of vertical control than RPM. The positive relationship between transaction costs uses of RPM and manufacturer concentration $(\partial \log p_3)/(\partial \log MC)$ is consistent with the view that a "manufacturer must possess some monopoly power in order to induce low-cost and efficient retailers of the product to sell at the higher maintained price, sheltering higher cost retailers" (Porter 1976, p. 65). Both $(\partial \log p_1)/(\partial \log MC)$ and $(\partial \log p_2)/(\partial \log DC)$ should be negative under a bilateral theory of the relationship between manufacturers and distributors. That is, concentration at the manufacturing or

distributing stage reduces the probability that RPM is employed to sustain a dealers' or manufacturers' cartel, respectively. While $(\partial \log p_1)/(\partial \log MC)$ is negative as predicted, $(\partial \log p_2)/(\partial \log DC)$ is positive. Thus, the evidence is not clearly consistent with this theory. The relationships between dealers' and manufacturers' cartel applications of RPM and market share are, respectively, positive and negative. Larger manufacturing firms are more likely to be the object of a dealers' cartel and less likely to be involved with a manufacturer cartel. The theoretical rationales for these results are not immediately obvious. Clearly, much remains unknown about the relationship between manufacturers and dealers and its dependence on the structural and transactional characteristics of industries.

V. DISCUSSION AND IMPLICATIONS

The analysis conducted in this paper possesses several implications. To begin, it indicates that a single view of the motivations and effects of RPM is inconsistent with the data. The calculations derived from the capital market analyses indicate that there are three distinct rationales for using RPM. The posterior probabilities assuming equal priors that RPM is employed for a given purpose correlates, at a statistically significant level, with variables suggested by the dealers' and manufacturers' cartel and transaction costs hypotheses. Higher levels of concentration in the distribution and manufacturing industries, proxies for the degree of intra-industry coordination, correlate directly with higher probabilities that RPM is facilitating a dealers' and manufacturers'

cartel, respectively. Greater market shares, an indication of increased agency costs, correlate directly with the probability that RPM is employed to reduce the costs of disintegrated distribution. This evidence indicates that RPM is used for a wide variety of reasons. It also suggests a set of variables that could help distinguish among the effects of RPM in different cases.

This finding has implications for contemporary antitrust policy. Some scholars of antitrust law argue that RPM be held legal per se (Bork, 1978; and Posner, 1981). A former practitioner of antitrust policy favors adjudication of complaints against RPM under a structured rule of reason criterion (Baxter, 1982). Many favor the continued per se illegality of the practice (Pertschuk and Correia, 1983). The empirical results presented above are incongruous with either a per se legal or illegal antitrust approach towards RPM. RPM is found both to foster cartels and enhance the efficiency of product distribution. Moreover, the structural characteristics of the manufacturing and distributing industries are fundamentally related to the motivations and economic effects of this vertical restriction. These results question the current per se illegal doctrine applied to RPM and suggest that an appropriate rule of reason criterion can be forged.

The analysis conducted above also yields additional inferences about RPM. For instance, the probability of observing RPM used to mitigate the agency problems of disintegrated distribution is inversely related to concentration among dealers and directly related

to manufacturer concentration. The former result is consistent with the hypothesis that the bargaining costs associated with any generalized joint production problem are smaller the fewer the players. The later result is consistent with the view that it is sometimes in the interest of a monopolistic manufacturer to preserve differentially efficient dealers. The probability of observing RPM used to facilitate a dealers' cartel is inversely related to concentration at the manufacturing stage. This relationship is consistent with a bilateral theory of the relationship between manufacturers and dealers. Additional inferences about the use of RPM and the relationship between manufacturers and dealers can be gained by including pertinent variables in estimations of system (2).

And finally, capital market studies are frequently used to analyze the economic effects of regulation and propositions in industrial organization. By examining the effects of regulatory induced wealth transfers, tests of theories are made possible. This methodology has come under increasing scrutiny. Often, extraneous information may confound interpretations of the qualitative response of an asset to regulatory perturbations (Halpern, 1983). Assessing the average effect on asset prices may cloak much of the relevant information. The inability to identify precisely the moment new information is impounded in security prices may drastically reduce the power of the associated tests (Binder, 1985). The methodology employed in this paper estimates the distribution of regulatory (RPM antitrust complaints) induced wealth effects inferred from the capital

market studies as a function of variables suggested by the disparate theories. A test of the joint hypothesis that inferences drawn from the capital market studies are not valid and the alternative theories of RPM have little predictive power is thus conducted. The proposition that the capital market analyses are of little value in analyzing the economic effects in question is refutable. Indeed, in the current analysis refutation is warranted. Inferences based on analyses of the estimated distribution of motivations and effects of RPM are valid. This approach has broader applications for the analysis of other forms of vertical control and, in general, propositions in industrial organization.

VI. CONCLUSION

This paper conducts tests of the alternative theories of RPM. These tests are accomplished by relating estimates of the economic effects of RPM for a cross-section of observations to necessary conditions of the alternative theories. Estimates of the effects of RPM are gained by observing the impact of antitrust complaints on the capitalized profits of relevant firms. It is shown above that the results of this analysis possess important implications for the theory of vertical control, public policy towards RPM, the strategic relationship between manufacturers and dealers in the distribution process, and the use of financial data and methodologies in analyzing industrial organization propositions.

Perhaps the single most important result contained in this paper is that positive support is found for each of the theories of

RPM. The data are consistent with the manufacturer cartel, dealer cartel, and transaction costs theories of RPM. This result is consistent with and indeed reiterates calls for a rule-of-reason antitrust approach towards RPM. This result is also consistent with the increasing body of case study evidence that indicates that RPM may be used for different reasons under varying circumstances. More importantly, this result indicates the importance of both the structuralist and transaction costs models for understanding phenomena in industrial organization.

FOOTNOTES

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1. See Scherer (1980) p. 3-6, for a discussion of the structuralist paradigm.

2. See Schwartz and Eisenstadt (1982) p. 43, for a discussion of how RPM facilitates a manufacturers' cartel.

3. See Coase (1937), Alchian and Demsetz (1972), and Williamson (1975) for a discussion of the transaction costs paradigm.

4. A simple model illustrates this point. Let $p(y,\sigma,a)$ represent the retail price of a product where y is quantity, $\sigma = (\sigma_1,\ldots,\sigma_i,\ldots,\sigma_n) \in S \subseteq \mathbb{R}^n$ a vector representing the activities undertaken by the n dealers to enhance the value of the product, and a, $a_0 \leq a < \infty$, manufacturer actions that enhance demand for y. Let y_i represent the quantity of the manufacturer's product distributed by the ith dealer and $v(y_i,\sigma_i)$ its costs. The ith dealer's profits are then

$\pi_i = [p(y,\sigma,\alpha) - w]y_i - v(y_i,\sigma_i)$ where w is the wholesale price of the product. Let $y_i^*(\sigma_i)$ be a maximizing choice of y_i for each value of σ_i. Then, using the envelope theorem, Nash equilibrium among dealers necessitates $\partial\pi_i/\partial\sigma_i = p_\sigma y_i^* - v_\sigma = 0$, $\forall$ iεN, where $p_\sigma > 0$ and $v_\sigma > 0$ are partial derivatives. A necessary condition for equilibria that maximize the joint profits of the dealers (Pareto optimal) is $\partial(\sum_{i=1}^n \pi_i)/\partial\sigma_i = p_\sigma \sum_{i=1}^n y_i^* - v_\sigma = 0$, $\forall$ iεN. Thus Nash equilibria are Pareto optimal iff $p_\sigma = 0$, $\forall$ iεN or $\sum_{i=1}^n y_i^* = y_i^*$, their is only one dealer.

RPM is represented by a constraint on dealer behavior such that $\Delta - p(y^*,\sigma,\alpha) = 0$ where $y^* = \sum_{i=1}^n y_i^*$ and Δ is the maintained retail price. Nash equilibria under the RPM constraint necessitate $p_\sigma(y_i^* + \lambda_i) - v_\sigma = 0$, $\forall$ iεN where λ_i is the Lagrangian multiplier. Equating this condition with that required for Pareto optimality yields $p_\sigma(y^* - y_i^* - \lambda_i) = 0, \forall$ iεN. Since λ_i is a positive monotonic function of Δ, there exist a Δ such that Nash equilibria of a distribution system with RPM are Pareto optimal.

5. Let w(p) now represent the wholesale price of a product as a function of the retail price. The ith dealer's profits are given above in footnote 4. The manufacturer's profits are $\pi_m = w(p)y^* - c(y^*,\alpha)$. Nash equilibria without RPM entails $p_\sigma(1 - w_p)y_i^* - v_\sigma = 0$, $\forall$ iεN, where w_p is the partial derivative. Pareto optimality implies $\partial(\pi_i + \pi_m)/\partial\sigma_i = w_p p_\sigma y^* + p_\sigma(1 - w_p)y_i^* - v_\sigma = 0$, $\forall$ iεN. Nash equilibria are Pareto optimal iff $p_\sigma = 0$ or $w_p = 0$. $p_\sigma > 0$ by assumption. $w_p = 0$ implies $\alpha = \alpha_0$. Thus for $\alpha > \alpha_0$, Nash equilibria are not Pareto optimal.

Nash equilbria of the RPM model necessitates $p_\sigma[(1 - w_p)y_i^* + \lambda_i] - v_\sigma = 0$, $\forall$ iεN . Equating this condition with that required for Pareto optimality requires $p_\sigma(w_p y^* - \lambda_i) = 0$, $\forall$ iεN . Again, since λ_i is a positive monotonic function of Δ, there exists a Δ where Nash equilibrium are Pareto optimal and $\alpha > \alpha_0$.

6. The success of RPM in overcoming the problems of moral hazard in distribution lies in its role as a non-balanced sharing mechanism (Holmstrom, 1982; and Kambhu, 1982). It achieves this by creating discontinuities in the profit functions of the dealers. The feasibility of this sharing rule can be invalidated by binding endowment constraints. The existence of vertical restrictions that are often observed in conjunction with RPM, such as territorial constraints, may be understood as property rights that are valuable to dealers and forfeited in equilibria where the market price does not attain the maintained retail price. Complimentary vertical restrictions, in this context, serve a bonding function. Other regularities of the distribution process, such as franchise fees, may also serve this function.

7. Recall that in the case of horizontal externalities among dealers, the coincidence of Nash and Pareto optimal equilibria

without RPM necessitates $p_\sigma[y^* - y_i^*] = 0$, $\forall$ $i \varepsilon N$. Thus, one way to mollify the externality problem when RPM is prohibited is to increase the proportion of the manufacturer's product distributed by any one dealer. The externality problem is less severe when the differences between y^* and y_i^* are small. Large retail outlets can address, though not solve, free-rider problems in distribution. Thus, the correlation between the size of retail outlets and the use (or absence) of RPM is perfectly explicable in a transaction costs framework.

8. See Gilligan (1984), p. 115-140 for a discussion of historical and contemporary public policy towards RPM. See, also, Areeda (1983) p. 19-22.

9. Recall that $p_\sigma[y^* - y_i^*] = 0$, $\forall$ $i \varepsilon N$ and $w_p p_\sigma y^* = 0$ are necessary for the coincidence of Nash and Pareto optimal equilibria in the distribution models without RPM developed above. When agency costs are present, i.e., strict equality does not obtain, the divergence of these equilibria are positive functions of y^*, the size of the manufacturing firm.

10. The use of financial data to approximate the profit consequences of the antitrust complaints is not without difficulties. Several biases can occur. For instance, potential legal liabilities or penalties can bias downward the profit effects of the manufacturer named in the antitrust complaint. Additionally, the manufacturer's competitors may also be using RPM. In this case,

information about future antitrust activities contained in the current antitrust complaint can bias downward the estimate of the competitors profits (Halpern, 1983). Moreover, the existence of arrangements beyond RPM between the manufacturers and the dealers is unknown. The existence of such structures (side payments) can lead to unknown biases. By relating the estimated effects of RPM drawn from the capital market analyses of antitrust complaints to necessary conditions of alternative theories, however, an indication of the extent of bias in the sample is yielded. That is, correlation between the necessary conditions and estimated effects of RPM reflects favorably not only on the alternative theories, but also on the absence of bias in the capital market analyses.

11. First, the interval of estimation (five years) is the longest possible yielding stationary parameter estimates for the market model. Use of a longer estimation period would violate empirically demonstrated pooling restrictions consistent with stock return data (Gibbons, 1980). Second, quite often individual securities are not traded regularly on a daily basis. This regularity, referred to as non-synchronous trading, can cause biases in the parameters of the market model when estimated using daily data (Dimson, 1979). The use of weekly return data (the geometric accumulation of daily data over a seven day period) minimizes the biases associated with infrequent trading. Third, recent empirical work demonstrates the presence of day-

of-the-week effects in daily stock return data (Gibbons and Hess, 1981). For several days dummy variables for the day-of-the-week are significant explanatory variables in a market model. Again, the use of weekly data minimizes the chance that changes associated with an antitrust challenge are spurious and due to a day of the week effect. And fourth, often studies employing the information event methodology detect abnormal stock returns prior to the formal announcement of the event. That is, information leakage is often exhibited in such studies. The use of weekly data together with the placement of the first information event day at the end of the first information event week permits detection of abnormal returns prior to the announcement. This detection is limited to six calendar days, however. Since there is a no a priori method to determine the existence or structure of the information leakage, further efforts to account for it are not undertaken.

The estimation of system (1) also recognizes a potential econometric exigency. The coefficients ($\alpha..,\beta..,\gamma..$) of the system are estimated jointly using Zellner's Seemingly Unrelated Regression Model (SURM) (Schipper and Thompson, 1983; and Binder, 1985). This technique accounts for the fact that there are common, industry-specific variables omitted from both equations. Although the estimated coefficients of SURM and ordinary least squares are identical when the same independent variables are contained in each equation, as is the case in system (1), tests

of statistical significance utilize the additional information contained in the covariance of the disturbance terms across equations. SURM assumes that these disturbances are independent and identically distributed within each equation and that, across equations, only the contemporaneous covariance of the disturbance terms is non-zero. These assumptions are consistent with observed stock market return data.

The specification of system (1) also distinguishes between two sources of potential stock return effects pursuant to the antitrust challenge. Changes in regulation, such as antitrust enforcement, can effect the stochastic properties of a security or portfolio of securities (Peltzman, 1976). Consequently, the parameters of the market model may change as a result of the antitrust action. The dummy variables D_{it} permit the parameters of the market model in system (1) to adjust as a result of the i, i=1,...,k, information events concerning the disposition of the antitrust action. Since a given D_{it} equals zero prior to the ith information event and one thereafter, the parameter estimates α_{fi}, α_{ci}, β_{fi}, and β_{ci} represent changes in the parameters of the market model due to the ith information event. By accounting for these changes, system (1) minimizes the possibility of interpreting changes in the stochastic properties of an individual security or portfolio of securities as changes in the future profits of these firms.

12. An appropriate statistic for this test is F(2m,2n-2q) where m is

the number of types of information (NEG_t,$POS_{t)}$, n is the number of return observations (260) and q the number of independent variables in each equation (Theil 1971, p. 314). Binder (1985) provides evidence that for certain n and q, F(2m,2n-2q) is biased against the null hypothesis. However, the bias is negligible for values of n and q considered in this study. Binder also provides an analysis of alternative statistics.

13. The results of capital market analyses are typically summarized by averaging the abnormal returns across observations in the sample (e.g., Dodd and Warner, 1983). The value of this construction depends, of course, on the hypotheses being tested. When there are diverse theoretical effects which, in a cross-section, can hold simultaneously, such a test is of little value. This is the case in the current study.

14. Most retailers, of course, never sell in national markets. The dealer concentration data used in this analysis pertains to the national level. These data represent a first-order approximation to local concentration measures since they are simply local measures averaged across the nation. Moreover, the correspondence between a manufacturing industry and the relevant distribution industry is not explicit. The author relied on years of personal shopping experience to create this correspondence.

15. The expression for $\partial \log p_1/\partial \log DC$ is derived to illustrate this

procedure. The derivative of the two equations in system (2) with respect to logDC yields $\partial \log p_1/\partial \log DC - \partial \log p_3/\partial \log DC = \delta_{11}$ and $\partial \log p_2/\partial \log DC - \partial \log p_3/\partial \log DC = \delta_{21}$. Clearly, there are three unknowns and only two equations. The derivative of $\sum_{i=1}^{3} p_i = 1$ yields the third equation. This derivative is equal to $(\partial \log p_1/\partial \log DC)\bar{p}_1$, + $(\partial \log p_2/\partial \log DC)\bar{p}_2$ + $(\partial \log p_3/\partial \log DC)\bar{p}_3 = 0$, where $\bar{p}_i$, i=1,2,3, are the cross-sectional means. Recursive substitution yields $\partial \log p_1/\partial \log DC = \delta_{11}(\bar{p}_2+\bar{p}_3) - \delta_{21}\bar{p}_2$. Thus, the elasticity between the four-firm measure of concentration in the distributing industry and the probability that a dealers' cartel rationale underlies the $\hat{\gamma}$ is equal to $\delta_{11}(\bar{p}_2+\bar{p}_3) - \delta_{21}\bar{p}_2$. The calculations for the other two elasticities of relevance for testing the RPM hypotheses are $\partial \log p_2/\partial \log MC = \delta_{22}(\bar{p}_1+\bar{p}_3) - \delta_{12}\bar{p}_1$ and $\partial \log p_3/\partial \log SH = -\delta_{13}\bar{p}_1 - \delta_{23}\bar{p}_2$.

APPENDIX

Table A.1 lists the complaints used in the current study. This table also lists information pertaining to the construction of the capital market analyses for these complaints.

The significance and assessment of the estimation results of system (1) for one observation in the sample are presented to illustrate the implementation and usefulness of the empirical formulation developed above. The case chosen for this illustration is the Federal Trade Commission v. Lenox. This case is chosen because it demonstrates many of the features of system (1). This case is also discussed and analyzed in greater detail elsewhere (Goldberg, 1980; and Marvel and McCafferty, 1984).

Table A.2 contains the information events used in the estimation of system (1) for FTC. v. Lenox. This table identifies the dates and type of information considered. Three of the events used in this case are deemed to increase the expected distribution costs or reduce the probability that RPM remains a marketing practice of Lenox. One event is classified as increasing the probability that RPM is continued. Table A.3 contains the names of firms whose securities are included in the competitors portfolio. These are firms whose securities are listed on the CRSP tape for the five-year period surrounding the antitrust action and whose primary SIC is the same as Lenox's. Finally, Table A.4 presents the SURM estimates of system (1) for FTC v Lenox. The t-statistics are reported below each parameter. Notice that since there are four information events, there are four

TABLE A.1

SAMPLE OF ANTITRUST COMPLAINTS AGAINST RPM

Name of Upstream Firm	Type of Suit	# of Firms in Competitor's Portfolio	# of Information events
American Oil(Standard of Indiana)	FTC	32	3
Beech Aircraft	JD	3	2
Bulova Watch	FTC	6	1
Clark Oil	Private	32	3
Colt Industries	FTC	2	1
Corning Glass Works	FTC	3	5
Crown Central Petroleum	FTC	32	1
Dejur-AMSCO	FTC	11	1
Du Pont	JD	9	1
Dymo Industries	JD	14	2
Ehrenreich	JD	1	1
Gamble-Skogmo	FTC	17	1
General Electric	JD	3	2
General Motors	JD	4	3
B.F. Goodrich	JD	10	2
Hammermill Paper	FTC	2	1
Interco	FTC	5	1
Lenox	FTC	3	4
Head Ski	FTC	3	1
Levi Strauss	FTC	7	4
Jonathan Logan	FTC	17	1
Lowenstein and Sons	JD	1	1
Signal Corp. (Mack Trucks)	JD	19	2
Magnavox	FTC	7	2
Max Factor	JD	14	2
Medalist Industries	FTC	10	1
Monsanto	Private	1	1
Olin Ski	FTC	4	3
Palm Beach	FTC	3	1
Piper Aircraft	JD	3	2
Charles Pfizer	JD	14	2
Quaker State	JD	32	1
Revlon	JD	14	1
Rubbermaid	FTC	16	4
Schlitz	FTC	4	2
Seagrams	JD	7	2
Shell Oil	Private	32	2
Simmons	JD	3	1
Sony	Private	13	3
Sohio	JD	32	2
Sun Oil	Private	32	1
Tandy	Private	1	1
Union OIl	Private	32	1
Wayne	JD	1	1
Wolverine	JD	3	1

TABLE A.2
FTC. v. Lenox
Information Events

News Date	News Summary	Classification
10/20/66	Alleged to violate FTC Act by fixing and maintaining prices at which its china dinnerware and other products are retailed by franchised dealers.	Negative
6/8/67	FTC Examiner ruled firm illegally fixed retail prices at which fine china dinnerware is sold by franchised dealers.	Negative
4/29/68	FTC orders firm to stop fixing prices of products at retail.	Negative
10/17/69	Appeals court lifted an FTC prohibition against price contracts between firm and dealers.	Positive

TABLE A.3
FTC v. Lenox
Competitor's Portfolio

Anchor Hocking Corporation
Corning Glass Works
General Steel Inds., Inc.

TABLE A.4
FTC v. Lenox
SURM Estimates

$$R_{ft} = \underset{(.0223)}{-.000138} + \underset{(.6433)}{.006815D_{1t}} + \underset{(.8151)}{.0087745D_{2t}} - \underset{(1.0499)}{.008613D_{3t}} - \underset{(1.1120)}{.008774D_{4t}} + \underset{(3.0682)}{1.0845R_{mt}} - \underset{(.1872)}{.131528D_{1t}R_{mt}} + \underset{(.8015)}{.613005D_{2t}R_{mt}} - \underset{(.5848)}{.330786D_{3t}R_{mt}} - \underset{(.8682)}{.354279D_{4t}R_{mt}} - \underset{(1.7788)}{.045723NEG_t} - \underset{(.1560)}{.007088POS_t}$$

$$R_{ct} = \underset{(1.6122)}{.004622} - \underset{(1.4327)}{.0070376D_{1t}} + \underset{(.5219)}{.0026050D_{2t}} + \underset{(.2231)}{.0008486D_{3t}} - \underset{(1.2120}{.004433D_{4t}} + \underset{(5.8975)}{.966524R_{mt}} + \underset{(.5597)}{.180305D_{1t}R_{mt}} - \underset{(.4908)}{.174051D_{2t}R_{mt}} + \underset{(.4629)}{.121379D_{3t}R_{mt}} + \underset{(1.4634)}{.276854D_{4t}R_{mt}} - \underset{(.8077)}{.009626NEG_t} - \underset{(3.3397)}{.070347POS_t}$$

SYSTEM R-SQUARE: .4119

H_o: $\hat{\gamma}_{ij} = 0$, for all i,j

F-VALUE: 3.8225

P-LEVEL: .0045

D_{it}. Recall that these dummy variables, which are equal to zero prior to the ith information event and one thereafter, permit the intercept parameter (α) and the coefficient on the return to the market portfolio (β) to change with each information event. Notice also that since three of the information events reflect negatively and one positively on the continued legal viability of RPM for Lenox, both NEG_t and POS_t are included in the estimation.

How important was the practice of RPM to Lenox and its competitors? How valid are the assumptions employed in this empirical formulation for analyzing the effects of FTC v. Lenox? An analysis of the statistical significance of the abnormal return parameters of system (1) reflects jointly on these questions. In the three weekly periods in which news impinging on the legal viability of Lenox's marketing practice of RPM occurred, the return on its securities was 4.57 percent lower than the average return over the 256 periods in the estimation interval in which no antitrust information occurred. The return to Lenox's competitors over these event periods was .96 percent lower than on average. Neither of these differences by themselves was statistically different from zero at the five percent level. In the one week period in which news facilitating Lenox's RPM practice occurred, the return on its securities was .71 percent lower while Lenox's competitors' returns were 7.0 percent lower. The decline in the competitor's returns was highly significant. A test of the null hypothesis that all of the abnormal return parameters of the system are equal to zero yields an F-statistic of 3.8225 which is significant

at the .0045 probability level. Thus, it does appear as though FTC v. Lenox had some measurable effect on the future profits of Lenox and its competitors.

The posterior probability that each of the alternative rationales for RPM underlies the $\hat{\gamma}$ of system (1) for FTC v. Lenox may be calculated using Bayes Theorem, the assumption that the elements of γ are independent and $N(\hat{\gamma},\hat{\sigma}_\gamma)$, and assuming equal priors. The likelihood that a dealers' cartel underlies the $\hat{\gamma}$ is equal to the probability that $\hat{\gamma}_{f1} > 0$ and $\hat{\gamma}_{f2} < 0$ times 1/3, the inverse of the number of theories consistent with the parameter estimates of the second equation. The probability that $\hat{\gamma}_{f1} > 0$ is equal to .0376 and the probability that $\hat{\gamma}_{f2} < 0$ is equal to .5620. Thus, the likelihood that a dealers' cartel underlies $\hat{\gamma}$ is .0071. Conversely, the likelihood that a manufacturers' cartel underlies $\hat{\gamma}$ is equal to the probability that $\hat{\gamma}_{f1} < 0$ and $\hat{\gamma}_{f2} > 0$ times $\hat{\gamma}_{c1} < 0$ and $\hat{\gamma}_{c2} > 0$. These probabilities are equal to .9624, .4380, .7904, and .0004, respectively. Thus, the likelihood that a manufacturers' cartel underlies $\hat{\gamma}$ is .0001. And finally, the likelihood that a transaction costs rationale underlies the $\hat{\gamma}$ of system (1) for FTC v. Lenox is equal to the probability that $\gamma_{f1} < 0$ and $\gamma_{f2} > 0$ times the probability that $\gamma_{c1} > 0$ and $\gamma_{c2} < 0$. These probabilities are equal to .9624, .4380, .2096, and .9996, respectively. Thus, the likelihood that a transaction costs rationale underlies $\hat{\gamma}$ is .0883. The posterior probabilities of the alternative theories are simply the normalized likelihoods given equal priors. Thus,

$p_1 = .074$, $p_2 = .001$, and $p_3 = .925$ where p_1, p_2, and p_3 are the posterior probabilities that the $\hat{\gamma}$ are generated in regimes consistent with a dealers' cartel, manufacturers' cartel, and transaction costs applications of RPM, respectively. The evidence from the capital market suggests that the most likely rationale for RPM in the case of Lenox was to enhance efficiency in product distribution.

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